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ABSTRACT

Drawing from a literature review of books, periodicals, and documents published since 1971, this paper provides the necessary background for a business/industrial trainer to reach trainees more effectively by identifying students' learning styles and matching styles with appropriate strategies for teaching/learning. Part A provides a summary of the literature on adult learning styles, focusing on the nature and the dimensions of learning styles and the educational implications of cognitive styles. Part B discusses various group and individual instructional methods, offers a brief outline of 14 teaching techniques, and considers the relationship of teaching methods and techniques to learning styles. Finally, part C recommends the approach to meeting individual learning styles used in the Learning Center at Bunker Hill Community College. The Bunker Hill approach, a delivery system for individualized, personalized curriculum based on mastery-level skills, centers on the premise that the individual's cognitive learning style paired with a complementary method of instruction may be the most successful approach to learning. Appendices include a learning style inventory and bibliography. (EJV)

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IDENTIFYING LEARNING STYLES
AND
MATCHING STRATEGIES FOR TEACHING AND LEARNING

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INTRODUCTION

This paper will provide the necessary background for a business/industrial trainer to reach trainees more effectively by identifying their learning styles and matching appropriate strategies for teaching/learning. The organization and limitations of this project are outlined below.

Organization of the Report

This paper will be divided into the following sections:

Part A. Literature Review Summary on Adult Learning Styles

Part B. Methods and Techniques Affecting or Influencing Learning Styles

Part C. Approaches to Meet Individual Learning Styles

Limitations

This paper has the following limitations:

1. The literature review will be limited primarily to those books, periodicals, and documents published since 1971. A computer search was used for this purpose.

2. Although the literature discusses a number of learning styles, this report will review three widely used models. They are (a) Joseph Hill's work on cognitive style mapping;

(b) David Kolb's learning style based on Lewin's cycle of experiential learning; and (c) Herman Witkin's cognitive style based on the field-dependence-independence dimension.

PART A: LITERATURE REVIEW SUMMARY ON ADULT LEARNING STYLES

In the examination of the literature related to this topic few materials were found to deal exclusively with the various types of learning styles. The articles, documents, and reports reviewed may be generally classified in two areas: (1) those studies and articles relating to the nature and the dimensions of learning styles; and (2) those materials pertaining to the educational implications of cognitive style. Thus, to bring this information into proper focus, the studies reviewed for this paper will be divided into the above classifications.

Nature and Dimensions of Learning Styles

There are a number of spheres of thought which relate to the subject of adult learning. Perspectives on adult learning have emerged from the research and the theories on developmental stages and life phases. Another sphere of thought which has important implications for adult learning is that of cognitive or learning styles. The learning styles of adults provide another view from which the similarities and individual differences of adults may be understood.

People derive meaning from the world around them in a variety of fashions. Some individuals prefer to learn by listening; others learn best by observing; and still others like to learn by reading. Systematic methods are used for solving problems by some learners, while others approach the learning task from a more global perspective. The individual preferences and characteristic modes of functioning exhibited by learners are known as cognitive styles or learning styles. Kogan gives this definition of cognitive style:

> Cognitive style can be most directly defined as individual variation in modes of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming, and utilizing information. (23:244)

Even provides us with additional insights as to the meaning of cognitive style. She states:

> Cognitive styles, diverse ways of taking in information and processing it, usually develop by 12 years of age and remain rather stable over the years. A style has broad influence on aspects of personality and behavior, perception, memory, problem solving, interests, and career goals as well as social behavior. (7:9)

Brundage differentiates between cognitive style and learning style in his definition. He reports:

> Consistent individual differences in the ways of organizing experiences into meanings, values, skills, and strategies are called cognitive styles. Consistent individual differences in the ways of changing meanings, values, skills, and strategies are called learning styles. (4:45)

Both Kogan and Brundage note that performance level and ability have the same properties as cognitive styles. However, they caution that abilities concern the level of

competence and the sufficiency of skill. Cognitive styles, on the other hand are concerned with the manner and form of knowing.

Witkin outlines essential characteristics of cognitive styles in general. Witkin describes one of these characteristics:

> . . . cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences in how we perceive, think, solve problems, learn, relate to others, etc. (50:15)

The pervasive dimension of cognitive styles is the second characteristic noted by Witkin. He states:

> . . . cognitive styles are pervasive dimensions. They cut across the boundaries traditionally--and, we believe, inappropriately--used in compartmentalizing the human psyche and so help restore the psyche to its proper status as a holistic entity. (50:15)

A third characteristic outlined by Witkin is the stability of cognitive styles over time. Styles may be altered, but other researchers have also underscored this point. Tarule and Weathersby concur:

> Basic learning style preferences probably remain consistent from childhood to adulthood, although they may be expanded or deepened over time as a result of socialization, specialization, or the conscious acquisition of methods and procedures with opposite strengths. (41:17)

And Witkin has this to report on the stability of cognitive styles:

> In the normal course of events, . . . we can predict with some accuracy that a person who has a

> particular style one day will have the same style the next day, month, and perhaps even years later. (50:15)

Most definitions of cognitive style make note of stability, including this one by Kagan and Moss:

> . . . "cognitive style," a term that refers to stable preferences in mode of perceptual organization and conceptual categorization of the external environment. (18:74)

The fourth characteristic of learning style is that they are value neutral. Witkin reports:

> . . . with regard to value judgments, cognitive styles are bipolar. This characteristic is of particular importance in distinguishing cognitive styles from intelligence and other ability dimensions. . . . With cognitive styles, . . . each pole has adaptive value under specified circumstances, and so may be judged positively in relation to those circumstances. (50:16)

In other words, no cognitive style is better than another style, nor does one style "represent greater developmental complexity." (46:105)

Kogan includes Samuel Messick's (1970) nine cognitive styles in his discussion of the various types of learning styles. These nine styles include the following:

1. Field independence vs. field dependence: an analytical, in contrast to a global, way of perceiving (which) entails a tendency to experience items as discrete from their backgrounds and reflects ability to overcome the influence of an embedding context.

2. Scanning: a dimension of individual differences in the extensiveness and intensity of attention deployment, leading to individual variations in the vividness of experience and the span of awareness.

3. Breadth of categorizing: consistent preferences for broad inclusiveness, as opposed to narrow exclusiveness, in establishing the acceptable range for specified categories.

4. Conceptualizing styles: individual differences in the tendency to categorize perceived similarities and differences among stimuli in terms of many differentiated concepts, which is a dimension called conceptual differentiation, as well as consistencies in the utilization of particular conceptualizing approaches as bases for forming concepts (such as the routine use of concept formation of thermatic or functional relations among stimuli as opposed to the analysis of descriptive attributes or the inference of class membership).

5. Cognitive complexity vs. simplicity: individual differences in the tendency to construe the world, and particularly the world of social behavior, in a multi-dimensional and discriminating way.

6. Reflectiveness vs. impulsivity: individual consistencies in the speed with which hypotheses are selected and information processed, with impulsive subjects tending to offer the first answer that occurs to them, even though it is frequently incorrect, and reflective subjects tending to ponder various possibilities before deciding.

7. Leveling vs. sharpening: reliable individual variations in assimilation in memory. Subjects at the leveling extreme tend to blur similar memories and to merge perceived objects or events with similar but not identical events recalled from previous experience. Sharpeners, at the other extreme, are less prone to confuse similar objects and, by contrast, may even judge the present to be less similar to the past than is actually the case.

8. Constricted vs. flexible control: individual differences in susceptibility to distraction and cognitive interference.

9. Tolerance for incongrous or unrealistic experiences: a dimension of differential willingness to accept perceptions at variance with conventional experience. (Messick in 23:246)

Cognitive style mapping, developed by Hill, and the learning style inventory of Kolb, based on Lewin's cycle of experiential learning, should also be added to the above list. The first nine styles are limited to specific traits and abilities. Weathersby underscores this point:

> These formulations of cognitive style, . . . are atomistic in their concentration on single traits and abilities and their lack of connection to a holistic theory that purports to encompass the major functional modes of learning. (46:105)

The literature review uncovered one other study conducted by Riechmann and Grasha. For research purposes, the Grasha-Riechmann Student Learning Style Scales, were developed to assess and distinguish six student learning styles based on the types of learning styles students demonstrate in the classroom.

1. Independent. This response style is characteristic of the student who likes to think for himself. He prefers to work on his own. . .

2. Dependent. This style is characteristic of the student who shows little intellectual curiosity and who learns only what is required. He sees teachers and peers as sources of structure and support. . . .

3. Collaborative. This style is typical of the student who feels he can learn the most by sharing his ideas and talents. . . .

4. Competitive. This response style is exhibited by the student who learns material in order to perform better than others in the class. . . .

5. Participant. This style is characteristic of the student who wants to learn course content and likes to go to class. He takes responsibility for getting the most out of class. . .

6. Avoidant. This response style is typical of a student who is not interested in learning course content in the traditional classroom. He does not participate with students and teachers in the classroom. . . . (32:221-222)

A search of the literature indicates that three styles have gained some prominence in the field of education. They are: (1) Hill's work on cognitive style mapping; (2) Kolb's learning style based on Lewin's cycle of experiential learning; and (3) Witkin's cognitive style based on the field-dependence field-independence dimension. This writer uncovered very little material on eight of the styles outlined by Messick or on other styles outlined on the previous pages. Therefore, the remainder of this section will be devoted to a discussion of the literature on the work of Hill, Kolb, and Witkin.

Dr. Joseph E. Hill, president of Oakland Community College, in Bloomfield Hills, Michigan, created a structure called the Educational Sciences. The program was used to a limited extent at Wayne State University in an adult education program and on a wide-spread basis at Oakland Community College. In developing the structure called the Educational Sciences, Hill makes certain assumptions. They are:

(1) Education is the process of searching for meaning.

(2) Thought is different from language.

(3) Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols.

(4) Not content with biological satisfactions alone, man continually seeks meaning. (Hill and Nunnery in 29:75)

In order to understand cognitive style mapping, one must understand the seven sciences and their structures as proposed by Hill.

The first science is concerned with symbols and their meanings. According to Neil:

> Its primary assumptions are that humankind uses two kinds of symbols--theoretical and qualitative, and that these symbols are basic to the acquisition of knowledge and meaning. (29:75)

Students may be tested in order to determine whether they are primarly "readers" or "listeners."

The second science is concerned with cultural determinants of the meanings of symbols. "It centers on the cultural influences that affect what symbols mean to particular individuals." (29:76)

Tests will unveil student preferences for studying alone or with peers as well as the relationship of problem solving and priority setting to family values.

The third science is form of inference. This is the form of inference a person tends to use. Neil states:

> A student may use categorical reasoning, reason by comparison and contrast, synthesize a number of components into a related unity, or employ all of these processes to appraise the situation and draw a conclusion. (29:76)

The fourth science is that of memory-concern. According to Neil:

> Short- and long-term memory functions and their relationship to energy and biochemical elements are exceedingly complex. The memory processes of recognition, retention, recall, and association are identified in the testing process by the "concern" components relating to persons, processes, and properties. (29:76)

The fifth science is cognitive style. This is the individual's preferred learning style. Neil reports:

> The fifth science is the product of the first four sciences. . . . the consistency and pattern of expressive behaviors. (29:76)

The sixth science proposed by Hill is teaching, counseling, and administrative style. Neil provides this description.

> Each of these styles is represented as a product of three sets of information pertaining to demeanor, emphasis, and symbolic orientation. (29:77)

The seventh science is called systemic analysis decision making. This is an educational systems theory. Neil outlines this science:

> Basic to the system is the statement of goal or mission, which includes specific performance criteria and determines inputs. The outputs are measurements of how well the results fulfill the mission. The educational process requires much human feedback, communication, and modification or revision in order to keep the system adjusted. (29:77)

A further dimension of the Hill model is outlined by Pfleger and Pulvino. They state:

> In Hill's system individuals can acquire meaning from their environment through the sense of hearing (auditory), smell (olfactory), taste (savory), touch (tactile), and sight (visual). He has developed inventories to measure preference for each. (31:3)

In the use of the Hill model, students are provided with a computer printout which "maps" their cognitive traits and

provides a description of their particular cognitive style. This informaion is obtained from inventories and standardized tests which measure preferences.

This writer uncovered five documents in particular that were related to or used the Hill model of cognitive mapping. A paper written by Griffin entitled, "Cognitive Style: A Science to Influence the Policy of Individualizing Instruction," discussed the use of three of the Educational Sciences--symbolic orientation, cultural determinants, and modalities of inference, to discover the learning style of students at Central Piedmont Community College. Thirty-three freshman developmental students at Piedmont were tested to determine their learning styles. The document demonstrates that the conceptual framework for determining learning styles exists in the theory of Educational Sciences developed by Hill.

Heun and others report on "Maximizing Individual Student Learning Through Cognitive Style Mapping," The authors report:

> Mapping the cognitive style of individual learners is one attempt to gain more precision and accountability in solving learning problems in education. . . . Cognitive Style Mapping is a diagnostic procedure . . . in that it is designed to determine how a person derives meaning from the world around him, specifically how he encodes, processes and decodes meanings. (12:1)

Heun, Heun, and Ratcliffe emphasize the edumetric uses of the cognitive style map instrument. They state:

> The Cognitive Style Map Instrument is primarily designed for edumetric uses rather than psychometric uses. It is designed to measure the gain or growth of an individual's knowledge, learning skills or abilities (comparing him with himself) rather than measuring individual differences in relation to a group (comparing him to others). (12:1)

A paper by Jane Harper on "Individualized Instruction and The Students Who Need it Most," discusses the cost factors of individualized instruction and the various methods used to select students for individualized instruction (among them individualizing only first-year courses or advanced courses). She suggests that selecting students according to their learning style may be a more ideal way when cost factors limit the number of those who may enter an individualized program. She recommends using cognitive style maps as a criterion for selection. Harper concludes:

> Research indicates that certain elements must be present in one's cognitive style map to profit from independent study, programmed materials, and individual tutoring sessions: (1) theoretical auditory linguistic; (2) theoretical visual linguistic; (3) qualitative code synnoetics (knowledge of oneself) and qualitative code ethic; (4) an individual cultural determinant; (5) magnitude processes of deriving meaning; and (6) relationship processes of deriving meaning. (11:1)

Cognitive Style Mapping and Matching Reading Program Alternatives" is discussed in a paper sponsored by the Naigara Falls Board of Education under the sponsorship of the Office of Education (DHEW), Washington, D. C.

> Cognitive style mapping enables adult basic education (ABE) teachers to more readily identify a student's cognitive style, or preferred way of acquiring information, as well as the specific areas where improvemement is needed. (5:1)

A second learning style which was prominent in the review of the literature was that of Kolb. A description of this model is presented by Williams:

> . . . he conceptualizes learning as a four-stage process. The first stage, concrete experience, is followed by observations and reflections. This leads on to the formation of abstract concepts and generalizations which should be followed by testing the implications of concepts in new situations. This then leads into a further cycle of new experiences and so on. (47:389)

Williams used the Kolb model in a course for adult educators to help them reflect on the way they learned in order for them to gain a better understanding of adult learning problems.

Most other material gathered by this writer on the Kolb Learning Style was that written by David A. Kolb. Kolb describes the experiential learning model:

> The experiential learning model represents an integration of many of the intensive lines of research on cognitive development and cognitive style. The result is a model of the learning process that is consistent with the structure of human cognition and the stages of human growth and development. It conceptualizes the learning process in such a way that differences in individual learning styles and corresponding learning environments can be identified. (26:235)

However, one study which used the Kolb model was conducted by Hunter and McCants. (15) They studied students' preferred learning style at Sinclair Community College in Dayton, Ohio, using the Learning Style Inventory developed by Kolb. The older students in this study showed a preference for a structured environment stressing organization and detailed instructions. Younger students, on the other hand, preferred peer and teacher affiliation in the learning environment.

Kolb's experiential learning theory is so called because the term has historical origins in the social psychology of Lewin in the 1940's. It also ties to the sensitivity training of the 1950's. The emphasis is the role ". . . that experience plays in the learning process, an emphasis that differentiates this approach from other cognitive theories of the learning process." (26:235)

Kolb developed the Learning Style Inventory (LSI) to measure individual learning styles derived from experiential learning theory.

The individual's emphasis on four learning abilities are measured by the Learning Style Inventory. These are, according to Kolb:

> Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE)--plus two combination scores that indicate the extent to which an individual emphasizes abstractness over concreteness (AC-CE) and the extent to which an individual emphasizes action over reflection (AE-RO). (25:1)

Kolb continues:

> A closer examination of the four-stage learning model indicates that learning requires abilities that are polar opposites, and that the learner, as a result, must continually choose which set of learning abilities to bring to bear on various learning tasks. More specifically, there are two primary dimensions to the learning process. The first dimension represents the concrete experiencing of events, at one end, and abstract conceptualization at the other. The other dimension has active experimentation at one extreme and reflective observation at the other. Thus, in the process of learning, one moves in varying degrees from actor to observer, from specific involvement to general analytic detachment. (26:236)

Kolb emphasizes that socialization experiences, both past life experiences and present experiences, resulting from the demands of the environment aid in the development of a learning style. The Learning Style Inventory measures the individual's strengths and weaknesses as a learner. Kolb describes these styles as Converger, Diverger, Assimilator, and Accommodator.

Kolb has this to say about the Converger Style:

> Convergers' dominant learning abilities are Abstract Conceptualization and Active Experimentation. Their greatest strength lies in the practical application of ideas. . . . persons with this style . . . do best in those situations, like conventional intelligence tests. . . . These persons ogranize knowledge in such a way that . . . they can focus it on specific problems. . . . They tend to have narrow interests and often choose to specialize in the physical sciences. (26:238)

The Diverger Style is described by Kolb:

> They are best at Concrete Experience and Reflective Observation. Their greatest strength lies in imaginative ability. They excel in the ability to view concrete situations from many perspectives and to organize many relationships into a meaningful "gestalt." . . . persons of this type perform better in situations that call for generation of ideas, such as "brainstorming" sessions. Divergers are interested in people and tend to be imaginative and emotional. . . . Counselors, organization development consultants, and personnel managers often have this learning style. (26:238)

Kolb provides this description of Assimilators:

> . . . dominant learning abilities are Abstract Conceptualization and Reflective Observation. Their greatest strength lies in the ability to create theoretical models. They excel in inductive reasoning, in assimilating disparate observations. . . . They are less interested in people and more concerned with abstract concepts, but less concerned

> with the practical use of theories. . . . this learning style is more characteristic of the basic sciences and mathematics than of the applied sciences. (26:238)

In conclusion, the Accommodator Style is outlined by Kolb:

> They are the best at Concrete Experience and Active Experimentation. Their greatest strength lies in doing things . . . and becoming involved in new experiences. They tend to be risk takers . . . persons with this style tend to excel in situations that call for adaptation to specific immediate circumstances. . . . They tend to solve problems in an intuitive trial-and-error manner, . . . Accommodators are at ease with people but are sometimes seen as impatient and "pushy." Their educational backgrounds are often in technical or practical fields such as business. . . . people with this learning style are found in "action-oriented" jobs, often in marketing or sales. (26:238)

The literature review produced a third model of learning style, Field-Independence vs. Field-Dependence, researched by Witkin and others. This cognitive style is probably the best known of the three discussed in this paper. Support to this statement is given by Kogan:

> Of all the cognitive styles under consideration . . . the field-independence-dependence dimension is unquestionably the most widely known and thoroughly researched. (23:247)

This is underscored by Witkin and others:

> Among the cognitive styles identified to date, the field-dependence-independence dimension has been the most extensively studied and has had the widest application to educational problems. (50:1)

Witkin and associates use three tests to ". . . ascertain the extent to which the surrounding visual framework dominates perception of an item within it." (49:41) The

first test requires the subject to align a rod with a surrounding frame; the second test uses the subject's body as the object of perception, using a room and chair to be tilted clockwise or counterclockwise, together or independently. The third test is one involving figures. A figure is shown, removed, and must be located in a complex, organized field.

A person's cognitive style is determined from his or her performance on one of these three tests. Witkin and others report:

> In all three situations, we come out with a quantitative indicator of the extent to which the subject's perception of an item has been influenced by the organized field surrounding it. In these three tests of field dependence versus independence, a more field-independent style is associated with greater accuracy. . . . people tend to be self-consistent in performance across these three tasks. (49:41)

Witkin sheds additional insight on this subject:

> . . . the common denominator underlying individual differences in performance in these various tasks is the extent to which the person perceives part of a field as discrete from the surrounding field as a whole, rather than embedded in the field; . . . the extent to which the person perceives analytically. (50:7)

Some of the more important findings as a result of the research done by Witkin and others on the field-dependent and field-independent cognitive styles are outlined below:

- Women tend to be more field dependent than men on the average. However, this differs in some societies, thus pinpointing the importance of the role of socialization in the development of sex differences in field-dependence-independence. (50:7)

- The styles that are first identified in perception tend to transfer to the problem solving domain. A person who is unable to separate an item from the surrounding field (field-dependent individual) is likely to have trouble with problems which require taking a critical element out of context in order to arrive at a solution. (50:8)

- Field-independent persons tend to impose structure on stimulus material which lacks structure. Ordinarily, field-dependent persons leave the material "as is." (50:9)

- Field-dependent individuals, in contrast to those who are more field-independent, are attentive to and "tuned" to the social components of the environment. The thoughts and feelings of others are determined from people's faces as read by the field-dependent person. An interest in what people say and do and being sensitive to social clues is more characteristic of the field-dependent person. (50:10-11)

- Field-dependent individuals like people, like to be close to them, and are generally drawn to people in the way they use interpersonal space. (50:11)

- There is a tendency for the field-independent person to show more nonverbal behavior than the field-dependent individual (50:12)

- Field-independent persons tend to exhibit a more impersonal orientation. They are more interested in the abstract and the theoretical. (50:12-13)

- There is a tendency among field-dependent persons to select vocations in which they are involved with others and subject-matter which features human content. · Solitary work environments and abstract subject matter are more often selected by the field-independent individual. (50:13)

- Field-independent persons are more likely to be aware of their own needs and feelings as opposed to those of others. These needs and feelings provide an internal frame of reference used by field-independent persons as they deal with external social referents. (50:13)

- Field-dependent people tend not to define social roles as distinct from the roles of those with whom they interact. (50:13)

- The relatively field-dependent person tends to experience the body as having limits and boundaries, whereas field-independent individuals have a more global concept of the body. (50:14)

- Specialized defenses and intellectualization are more often used by field-independent persons, whereas repression would be a defense favored by the field-dependent person. (50:14)

The nature of cognitive styles and the various cognitive styles have been reviewed on the previous pages. What are their implications for education?

Educational Implications of Cognitive Styles

The literature reviewed points to a number of important implications for the role of cognitive style in learning.

In a study on "Anxiety Level Modification by Cognitive Style Matching" the need to reduce student anxiety levels was addressed. Anxiety levels should be productive rather than destructive. "Student cognitive styles are matched to the cognitive style of the instructional mode to see if student anxiety levels are reduced." (44:13)

According to Terrell:

> This study indicates the modification of anxiety level as a dimension in the utilization of cognitive style matching and, thus, illustrates the value of employing cognitive style matching for individualization of instruction. (44:13)

The implications of cognitive style and vocational choice are numerous. "Each of us has a preferred style for solving problems. Knowing what it is--and fitting it to the right job--can be important to career success." (8:69)

A number of studies indicate that cognitive style may have an effect on career choice. According to Witkin:

> . . . educational-vocational choices show patterns of relations to cognitive style similar to those found for interests. . . . relatively field-independent persons favor impersonal domains which require competence in cognitive articulation and field-dependent persons favor interpersonal domains which do not call for that kind of cognitive competence. (50:43)

Witkin continues:

> In the academic setting, relatively field-independent college and graduate students are likely to choose for specialization such fields as, for example, the

> sciences, mathematics, art, experimental psychology, engineering, architecture. Relatively field-dependent students are likely to choose, for example, sociology, humanities, languages, social work, social services (religion), elementary school teaching, education, clinical psychology, writing, nursing. (50:42-43)

Also of educational significance are the findings by Witkin that field-independent students are more often found to perform better in mathematics and sciences. However, Witkin emphasizes:

> We have seen that field-dependence-independence does not show much relation to overall achievement measures, such as college grade-point average. (50:45)

The matching of teaching styles and learning styles has received some widespread attention in the literature. This has implications for pre-service and in-service teachers at the college level. Roberts reports the following in "Personalizing Learning Processes":

> . . . sensing . . . and judging . . . types prefer to teach and learn in an orderly, systematic manner using primarily their five senses and . . . they respond positively to varied multi-media instructional approaches and do not respond as well to the written or the spoken word . . . when used alone as instructional media. The intuitive . . . and perceptive . . . types . . . prefer to each and learn in a flexible, unstructured manner. (33:142)

A discussion of teaching, learning, and teacher-student interaction as a function of cognitive style is provided by Witkin. He reports:

> . . . a teacher's cognitive style may influence his or her way of teaching; . . . a student's cognitive style may influence his or her way of learning; and . . . a match or mismatch in

> cognitive style between teacher and student may determine how well they get along, with important consequences for the learning process. (48:25)

According to Witkin, those who choose careers in teaching are most likely field-dependent individuals. In terms of teaching strategy, the field-dependent teacher is likely to prefer the discussion method or discovery method versus the traditional lecture method, which appeals to field-independent individuals.

Cognitive style may also enter into the manner in which a student learns. Witkin reports:

> . . . how much knowledge students acquire by different teaching methods tends to be related to their cognitive style. (48:30)

The understanding of one's cognitive style, particularly for the adult, may provide assistance in learning. Smith and Haverkamp believe that adults need to acquire the knowledge and skill essential to effective learning in any situation they encounter. They state:

> . . . the adult learner needs to develop awareness and understanding of himself as a learner. (29:7)

Smith and Haverkamp continue:

> The adult educator who is sensitive to the matter of learning style will explore its implications for intake procedures. . . . He may well try to obtain information about the style of the learner entering his program. This in turn may lead to "streaming"--the providing of several alternatives as to the basic teaching learning approach to be used. (39:9)

Cognitive styles also have implications in education for the instructional technologist. Neil states:

> Knowing institutional goals or departmental or individual faculty objectives may well lead the technologist to use a measure of cognitive style . . . in order to meet a learning need or more effectively organize supportive services in the college. (29:77)

Other implications for education are outlined by Witkin:

- Relatively field-dependent persons are better at learning materials with social content, both in terms of superior memory for social information and when the material is peripheral to the task in which they are concentrating. (50:18)

- Field-dependent students would be more likely to require externally defined goals and reinforcements than field-independent students who tend to have self-defined goals and reinforcements. Thus, intrinsic motivation is more effective for the field-independent person. (50:19-20)

- Field-dependent people are more affected by criticism than field-independent people. The administration of the criticism (manner) will have an effect on learning. Thus, field-dependence-independence may provide a basis for prediction of the types of reinforcement which will be useful.

- Structuring of the learning material will have an effect on field dependent and field-independent learners. When the material to be learned is organized, the field-dependent learners will not differ from field-independent learners. Conversely, unstructured material will require organization by the field-dependent individuals who must structure the material in order to facilitate learning (50:21)

- Field-dependent individuals find it difficult to learn materials structured in a subordinate-to-superior sequence. (50:22)

- Field-dependent teachers are found to benefit more from video modeling than field-independent teachers who do as well with written as with video modeling. (50:22)

- In the area of programmed instruction, field-dependent students tend to perform better when they receive feedback from the text. (50:23)

- Field dependent students may require more explicit instructions in problem-solving strategies, more specific instruction in problem-solving areas, and more exact definitions of performance outcomes. (50:25)

- Class discussion has been judged by more field-dependent teachers to represent better teaching and be more effective for learning. (50:28)

- Field-independent teachers tend to use questions as instructional tools more frequently than field-dependent teachers. The latter tend to use questionning techniques to check on student learning. (50:28)

- Field-dependent teachers believe that the encouragement of students to set up a group standard is a useful teaching practice. Field-dependent teachers tend to be more student centered in their approach to education. (50:29)

- Negative evaluation is described by field-independent teachers to be an effective teaching technique. (50:29)

- Students of field-independent teachers perceive their teachers as encouraging students to apply principles; in contrast, students of field-dependent teachers think of their teachers as teaching facts. (50:29)

PART B: METHODS AND TECHNIQUES AFFECTING OR INFLUENCING LEARNING STYLES

This section will be devoted to a discussion of the various methods and techniques and how they affect or influence learning styles.

Methods

A method is an orderly process or procedure that an institution uses for providing education to its students. Bergevin, Morris, and Smith define method:

> An established or systematic order for performing any act or conducting any operation. The relationship established by an educational institution with a group of participants for the purpose of systematically diffusing knowledge among them. Some methods of adult education are correspondence study, the coordinated course, and community development. (3:243)

Verner, in Apps' discussion of procedures for continuing education, lists the following as individual methods appropriate to the education of adults:

> Correspondence study is pursued through a variety of techniques usually centered about those of written communication.
>
> Directed individual study is a relationship . . . established with the learner that involves some direct personal contact between the learner and the agent (educator) so that personal supervision of the learning process can be assured. . . .

> Apprenticeship is established . . . (when) the learner acquires knowledge and skills through direct participation in learning under immediate personal supervision in a situation that approximates the conditions under which the knowledge will be used. . . .
>
> Internship is "a relationship . . . established so that an individual can have an opportunity, under supervision, to integrate knowledge and skills already acquired through direct participation in a situation similar to that in which such integrated behavior ultimately will apply. (Verner in 2:167)

Aker classifies individual methods in a similar fashion. They include: (1) apprenticeship; (2) correspondence; (3) internship; and (4) tutorial. (1:ix)

The previous discussion of methods has centered on those appropriate to the education of individual adults. A variety of methods may be more pertinent to group instruction. Aker (1) lists thirteen different group methods. They include:

1. The Class
2. The Clinic
3. Community Development
4. The Conference
5. The Convention
6. The Demonstration
7. The Institute
8. The Laboratory
9. The Seminar
10. The Study Group
11. The Short Course
12. Trips, Tours, and Travel
13. The Workshop (1:x)

Some methods appear to be more appropriate to large groups than to small groups. The conference and convention are two methods which are more effective for a large group. The laboratory, the class, and the seminar, are more suitable for the small group.

Verner, in Apps' discussion of procedures for continuing education, includes the community in his classification of methods. Community methods are defined in this context:

> . . . those in which the primary orientation is toward the introduction of change and the alteration of behavior patterns within the social system as a unit with changes in individuals and sub-systems presumed to result from changes in the system of which they are a part. (Verner in 2:167)

Techniques

A technique is a detail of a procedure which makes learning easier. Bergevin, Morris, and Smith define technique:

> The way in which the adult educator arranges the relationships of learners and resources to assist the learners to acquire knowledge in a learning situation. (3:245)

A precise definition of technique is supplied by Verner in App's discussion of procedures for continuing education:

> . . . the relationship established by the institutional agent (adult educator) to facilitate learning among a particular and precisely defined body of participants in a specific situation. (Verner in 2:167)

In determining which technique to use in a given situation, the adult educator must make a careful diagnosis of the learning environment, the group and/or the individual, and then determine the technique or techniques which will be

most appropriate under the given set of circumstances. The choice of techniques will be influenced by the needs and interests of the participants, the goals and objectives of the learner(s), and the resources available to the instructor.

Bergevin, Morris, and Smith outline fourteen different teaching techniques. They include the following:

1. Colloquy: . . . a modification of the panel using six or eight persons--three representing the audience and three or four resource persons . . . A moderator directs the proceedings. . . . The general audience listens, but . . . may participate under the guidance of the moderator. (3:42-43)

2. Committee: . . . a small group of persons appointed or elected to perform a task that cannot be done effectively by an entire group . . . committees in adult education . . . plan and evaluate activities and . . . act in advisory capacity to persons directing programs. (3:55)

3. Demonstration: . . . a carefully prepared presentation that shows how to perform an act or use a procedure. . . . accompanied by appropriate oral and visual explanations, illustrations, and questions. (3:63)

4. Field Trip: . . . a carefully planned educational tour in which a group visits an object or place of interest for first-hand observation and study. (3:74)

5. Forum: . . . a 15- to 60-minute period of open discussion that is carried on among the members of an entire group . . . and one or more resource persons. The forum is directed by a moderator. (3:87)

6. Group Discussion: . . . purposeful conversation and deliberation about a topic of mutual interest among six to 20 participants under the guidance of a . . . leader. (3:95)

7. Interview: . . . a 5- to 30-minute presentation conducted before an audience in which one or two

resource persons respond to systematic questioning by an interviewer about a previously determined topic. (3:106)

8. Panel: . . . a group of three to six persons having a purposeful conversation on an assigned topic. . . . members are selected on the basis of previously demonstrated interest and competency in the subject to be discussed and their ability to verbalize . . . (3:116)

9. Quiet Meeting: . . . a 15- to 60-minute period of meditation and limited verbal expression by a group of five or more persons. . . . The quiet meeting requires a group of persons who are not strangers to each other. . . . It is used at a point when the leaders or members feel that reflection and contemplation are desirable. (3:127)

10. Role-Playing: . . . a spontaneous portrayal (acting out) of a situation, condition, or circumstance by elected members of a learning group. (3:135)

11. Seminar: . . . a group of 5 to 30 persons engaged in specialized study and led by a recognized authority in the subject being studied. (3:147)

12. Speech: . . . a carefully prepared oral presentation of a subject by a qualified person. It is frequently referred to as a lecture. (3:157)

13. Symposium (Ancient Concept): . . . a group of 5 to 20 persons who meet in the home or private room to enjoy good food, entertainment, fellowship, and with the desire to discuss informally a topic of mutual interest. (3:166)

14. Symposium (Modern Concept): . . . a series of related speeches by 2 to 5 persons qualified to speak with authority on different phases of the same topic or on closely related topics. (3:175)

Techniques may be classified according to their specific application. Some techniques are designed to help people

acquire information. The acquisition of a skill, on the other hand, may require other techniques and devices. The demonstration technique, for example, may be used by a typewriting instructor. The quiet meeting technique and a number of the others in the above list would be inappropriate in a typewriting classroom. Other techniques may be useful in situations in which the emphasis is on the application of knowledge.

Bergevin and others also employ the use of subtechniques in their discussion of techniques. They stress that it is important to consider the purpose and the function of the subtechnique. Bergevin, Morris, and Smith define subtechnique:

> A subtechnique is used to adapt a technique to the requirement of a particular teaching-learning situation. It cannot serve as the main procedure for a learning situation. (3:187)

A number of subtechniques are useful to supplement techniques in a variety of learning situations. Six of these are reviewed by Bergevin, Morris, and Smith. They include:

1. Audience Reaction Team
2. Buzz Session
3. Idea Inventory (Brainstorming)
4. Listening and Observing Groups
5. Question Period
6. Screening Panel

Learning aids or learning devices should be distinguished from techniques and methods. Some educators refer to these devices as learning aids or teaching aids. Films, filmstrips, slides, tapes, cassettes, transparencies, video tapes, and

video cassettes, computers, television, radio, educational telephone, etc., would be considered learning devices. The annotated reading list, the exhibit, and the case history are other educational aids. According to Bergevin, Morris, and Smith:

> Aids . . . represent resources, from which individuals or groups can acquire information. Aids are materials that can be used either at a meeting or for individual study at home. Their use usually helps learning by actively involving one or more of the learner's senses--such as the eye or ear--in a way that supplements or re-enforces what is presented or discussed in the group learning situtation. (3:207)

The Relationship of Methods and Techniques to Learning Styles

The relationship that various methods and techniques have to learning styles is complex. First, the learning style of the teacher or adult education leader will undoubtedly influence his or her choice of methods and techniques. As previously discussed in the literature review, the teacher's cognitive style will very likely influence the way he or she teaches, as well as the way the student learns. The match of teacher and student cognitive style may very well affect the learning outcome and the compatibility of teacher and student.

The literature on field-dependent and field-independent cognitive styles indicates that those who enter the teaching profession are most likely to be field-dependent individuals. These persons tend to enjoy working with others as opposed to working alone. Thus, field-dependent instructors may be

less likely to become involved with correspondence study or methods of instruction which would separate them from the learners. Witkin notes:

> Relatively field-dependent teachers have been found to prefer a discussion or discovery method of teaching, rather than a lecturing method, which is preferred by relatively field-independent teachers. (48:25)

Field-dependence and field-independence appears to have a direct relationship with the occupation selected by individuals. Witkin and associates indicate that mathematics and science teachers are likely to be field-independent. Field-dependent persons are more often found in the social sciences. Thus, in the early stages of an individual's education, where courses are required at the freshman and sophomore levels before a major has been selected, there may be more chance of a mismatch of teacher and student cognitive style. The literature indicates that students will perform better in those subjects in which their cognitive style is complementary. Witkin emphasizes that in certain subjects, such as mathematics and science, the field-dependent individual will perform better than expected if alternative methods and techniques which are in tune with their cognitive style are employed.

Research conducted by Harper and reviewed earlier in this paper suggests that those who profit from independent study, programmed materials, and tutorial sessions are likely to have certain elements in their "cognitive map." Students

lacking in some of these elements might have difficulty benefiting from the methods.

The second point of importance in the discussion of methods and techniques and their relationship to learning styles is that the literature has shown that learning styles are relatively stable over a period of time. Researchers are not willing to state emphatically that an individual's cognitive style will not change. They tend to agree that the style can be modified. Learners may increase in extent of field-independence up to the age of seventeen, but studies indicate that there is little change after that age and through the college years. Thus, it may be necessary for the teacher to consider changing and adapting his or her teaching style to meet the cognitive style of the learners. The various methods and techniques may have some influence on learning styles, but the research to date indicates that this effect may be minimal. A barrage of stimuli may well benefit the field-dependent learner who requires strong triggers for differentiation to occur. In contrast, this may be a waste of time for the field-independent type who may learn more quickly from quiet reflection.

A look at Kolb's learning styles--converger, diverger, assimilator, and accommodator--provide us with additional insights on the use of methods and techniques to accommodate the various learning styles.

As the converger's dominant learning ability is abstract conceptualization and active experimentation, many of these learners specialize in the physical sciences. The laboratory method is likely to fit the style of these students.

On the other hand, divergers, as described by Kolb, are more imaginative and emotional. Techniques which involve the interaction of the group are compatible with their learning style. Brainstorming is particularly appropriate for this group of learners.

The dominant learning ability of the assimilator is abstract conceptualization and reflective observation. Assimilators have the ability to create theoretical models, and inductive reasoning is one of their strengths. The internship method is particularly appropriate for the assimilator.

The accommodator's greatest strength lies in doing things and becoming involved in new experiences. A number of methods are complementary to the accommodator style. However, activities in which the learner plays a passive role are not appropriate. Techniques selected for teaching the accommodator are those in which the learner is actively involved in the learning situation.

For education to be effective, mathching the styles of the programs, the students, and the teachers may be necessary.

On the other hand, some students may be able to diversify their learning strategies. Cross makes an important point:

> Herein lies a danger of any automatic matching approach. A consistent match of teaching strategy to student cognitive style may leave the college graduate unprepared to cope with nonpreferred strategies that will inevitably face him or her in the real world. (6:128)

Thus, the matching of learning styles should depend on the circumstances and the goals of the learning situation.

PART C: APPROACHES TO MEET INDIVIDUAL LEARNING STYLES

The approach to meet individual learning styles recommended by this writer is the one used in the Learning Center at Bunker Hill Community College. "The Learning Center established at Bunker Hill Community College is a delivery system for individualized, personalized curriculum based on mastery-level learning concepts." (43:83)

The approach used in the Bunker Hill Learning Center is centered on the premise that a particular method of instruction may not be the significant factor to learning. Instead, the individual student's cognitive learning style paired with a complementary method of instruction may be the significant approach to successful learning.

The Bunker Hill Community College student may elect courses instruction based on his preference for one or more learning styles. According to Tenore and Dunbar:

> The outcomes of offering courses in all cognitive learning modes are three:
>
> 1. true individualization results, as each student may have a course load composed of courses offered in various instructional modes which which meet his individual preferred learning styles,

2. the student, rather than the modes of instruction, is the focal point of attention,

3. all modes of instruction are offered without institutional preference of one mode over another. . . . (43:28)

The conceptual approach used at Bunker Hill is based on the work of Hill in the area of cognitive style mapping. The approach used to determine the student's preferred learning style is ". . . based on how he approaches the theoretical and qualitative aspects of deriving meaning, the developmental relationship pattern he uses as he derives knowledge, and the method of reasoning that he uses as he moves through any situation where he is required to learn something." (43:29)

The following steps are used to identify the student's preferred cognitive style:

1. Diagnosing the students' entering skills behavior.

2. Careful prescriptions of learning sequences which start where the student is and are sequenced to his final educational goal.

3. Identification of each student's preferred learning style. (43:34)

In order to determine the student's individual learning style, a profile is developed. Questions providing partial input are contained in Appendix A. The following information provides a composite:

- The student's preference for reading or listening.
- The personal commitment level of the student
- Requirements of the learning experience, including the need for an authority figure, peer-group

interaction, or the preference for an independent mode allowing access to structured resources.

- The preferred reasoning method of the student. Does the learner reason in categories, relationships, comparison and contrasts, or combinations of the above?

- The student's use of sensory input.

After the student's profile is determined, a corresponding mode of delivery with appropriate learning sequences is assigned.

This approach uses programs which conform to a five-step system of evaluation. Tenore and Dunbar list five steps as the key factors in how programs operate in the system.

1. Determine entering-level of ability (pre-test).
2. Identify a series of specific objectives (competencies).
3. Identify matching post-tests for these objectives (criterion referenced).
4. Sequences of learning activities.
5. Enough performance data to determine validation. (43:35)

In conclusion, the approach to meet individual learning styles is one in which instruction is provided in multiple modes of delivery to match the learning style of the student. Thus, students from any academic discipline, students with a wide range of interests and needs, and adult learners as well as young learners may select instruction which fits their learning style.

APPENDIX A

LEARNING STYLE INVENTORY QUESTIONS

SAMPLE LEARNING STYLE INVENTORY QUESTIONS

1. I understand a topic better if I analyze it to learn how it differs from other topics.

1A

2. I _____find myself in the position of having to make a decision before I know enough about the situation.

2A

3. Life can be simpler if you go by the rules.

3A

4. Problem-solving involves related variables.

4A

5. I enjoy games or puzzles in which the solution is deduced from information contained in the rules.

5A

6. In my choice of clothing, I wear contrasting colors.

1B

7. When I attack a problem, I approach it from as many aspects as possible.

2B

8. I don't change my mind on a subject once I identify the rule which applies.

3B

9. I try to understand why people break rules.

4B

10. I find it easier to win an argument when I state the premise and give a conclusion which is inescapable: (Blank is true, therefore Blank must be true).

5B

11. I "play the devil's advocate" with people to force them to look at another point of view.

1C

SAMPLE LEARNING STYLE INVENTORY QUESTIONS (CONTINUED)

12. One cannot appreciate a problem unless he knows as much about it as possible.

2C

13. I prefer working in situations where standards and rules are stated explicitly.

3C

14. I like to figure out the way parts of a whole fit together.

4C

15. I avoid probability statements in solving problems.

5C

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BIBLIOGRAPHY

1. Aker, George F., Adult Education Procedures, Methods and Techniques, University College, Syracuse University, 1965.

2. Apps, Jerold W., "Developing a Teaching-Learning Rationale," Problems in Continuing Education, McGraw-Hill Book Company, 1979, pp. 150-174.

3. Bergevin, Paul, Morris, Dwight, and Smith, Robert, Adult Education Procedures, The Seabury Press, 1963.

4. Brundage, Donald H., and MacKeracher, Dorothy, "Adult Learning Principles and Their Application to Program Planning," Ontario Department of Education, Toronto, Canada, 1980, 134 p. ED 181 292.

5. "Cognitive Style Mapping and Matching Reading Program Alternatives," Niagara Falls Board of Education, New York. Sponsoring Agency: Office of Education (DHEW), Washington, D. C., n.d., ED 118 908.

6. Cross, K. Patricia, Accent on Learning, Jossey-Bass Publishers, Inc., 1976.

7. Even, Mary Jane, "Current and Future Trends in Adult Education Research," Lifelong Learning: The Adult Years, Vol. 2, No. 3, November, 1978, pp. 8-11.

8. Ewing, David W., "Discovering Your Problem Solving Style," Psychology Today, Vol. 73, December, 1977, pp. 69-70.

9. Grasha, Anthony F., "Observations on Relating Teaching Goals to Student Response Style and Classroom Methods," American Psychologist, Vol. 27, February, 1972, pp. 144-147.

10. Griffin, Thomas E., "Cognitive Style: A Science to Influence the Policy of Individualizing Instruction, Nova University, January, 1974, ED 104 449.

11. Harper, Jane, "Individualized Instruction and the Students Who Need it the Most," 1973, 7 p., ED 082 740.

BIBLIOGRAPHY (CONTINUED)

12. Heun, Linda, Heun, Richard, and Ratcliffe, Linnea, "Maximizing Individual Student Learning Through Cognitive Style Mapping," December, 1975, ED 119 250.

13. Hilgendorf, Allan, "Investigating the Interaction of Learning Styles and Types of Learning Experiences and Assessment of Their Impact on Learning in Post-Secondary Vocational-Technical Education Programs: Phase II, Final Report," 1974, 91 p., ED 119 682.

14. Hill, J. E., and Nummery, D. N., The Educational Sciences, Bloomfield Hills, Michigan: Oakland Community College Press, 1973.

15. Hunter, Walter E., and McCants, Louise S., "The New Generation Gap: Involvement Vs. Instant Information, Topical Paper No. 64," California University, Los Angeles, ERIC Clearinghouse for Junior College Information, 1977, 21 p., ED 148 412.

16. Jackson, O. N., "The Dynamics of Structured Personality Tests: 1971," Psychological Review, No. 78, 1971, pp. 229-248.

17. Kagan, Jerome, "Reflection Impulsivity and Reading Ability in Primary Grade Children," Child Development, No. 36, 1965, pp. 609-628.

18. Kagan, Jerome, and Moss, Howard A., "Psychological Significance of Styles of Conceptualization," in Basic Cognitive Processes in Children, Monograph of Society for Research in Child Development, No. 28, 1963, pp. 73-112.

19. Kagan, Jerome, Moss, Howard A., and Siegel, Irving E., "Conceptual Style and the Use of Affect Labels," Merrill-Palmer Quarterly, No. 6, 1960, pp. 261-278.

20. Kidd, J. R., How Adults Learn, Association Press, Follett Publishing Company, Chicago, 1973.

21. Klein, George S., Riley W. Gardiner, and Schlesinger, Herbert J., "Tolerance for Unrealistic Experience: A Study of the Generality of Cognitive Control," British Journal of Psychology, No. 54, 1962, pp. 41-55.

22. Knowles, Malcolm., The Adult Learner: A Neglected Species, Gulf Company, 1973.

BIBLIOGRAPHY (CONTINUED)

23. Kogan, Nathan, "Educational Implications of Cognitive Styles," in Psychology and Educational Practice, Edited by G. S. Lesser, Glenview, Illinois, Scott and Foresman, 1971, pp. 242-292.

24. Kolb, David A., Learning Style Inventory: Self-Scoring Test and Interpretation Booklet, Boston, McBer and Company, 1976.

25. Kolb, David A., The Learning Style Inventory: Technical Manual, Boston, McBer and Company, 1976.

26. Kolb, David A., "Learning Styles and Disciplinary Differences," Modern American College, Edited by Arthur W. Chickering, Jossey-Bass Publishers, Inc., 1981.

27. McKenney, James L., and Keen, Peter G. W., "How Managers' Minds Work," Harvard Business Review, No. 52, May-June, 1974, pp. 79-80.

28. Messick, Samuel, and Kogan, N., "Differentiation and Compartmentalization in Object-Sorting Measures of Categorizing Style," Perceptual and Motor Skills, No. 16, 1963, pp. 47-51.

29. Neil, Marion, "Cognitive Style: A New Aspect to Instructional Technology," in New Directions for Community Colleges, No. 3, Spring, 1975, pp. 73-80.

30. Pettigrew, T. P., "The Measurement and Correlates of Category Width as a Cognitive Variable," Journal of Personality, No. 26, 1958, pp. 532-544.

31. Pfleger, Lawrence R., and Pulvino, Charles J., "How Do Students Prefer to Learn?", 1977, 12 p. ED 148 768.

32. Reichmann, Sheryl Wetter, and Grasha, Anthony F., "A Rational Approach to Developing and Assessing the Construct Validity of a Student Learning Style Scale Instrument," The Journal of Psychology, No. 87, 1974, pp. 213-223.

33. Roberts, Dayton Young, "Personalized Learning Processes," Revista/Review Inter-Americana, No. 7, Spring, 1977, pp. 139-143.

34. Roberts, Dayton Young, and Lee, Hong Yong, "Personalizing Learning Process in Agricultural Economics," American Journal of Agricultural Economics, No. 59, December, 1977, pp. 1022-1026.

BIBLIOGRAPHY (CONTINUED)

35. Rogers, Everett M., "The Communication of Innovations in a Complex Institution," Educational Record, Vol. 49, No. 1, Winter, 1968, pp. 67-77.

36. Roueche, John E., and Pitman, John C., A Modest Proposal: Students Can Learn, Jossey-Bass Publishers, Inc., 1972.

37. Schlesinger, Herbert J., "Cognitive Attitudes in Relation to Susceptibility to Interference," Journal of Personality, No. 22, 1954, pp. 354-374.

38. Shalock, H. O., "Structuring Process to Improve Student Outcomes," New Directions in Higher Education, No. 16, Winter, 1976, pp. 25-54.

39. Smith, Robert M., and Haverkamp, Kay K., "Toward a Theory of Learning How to Learn," Adult Education, Vol. 28, No. 1, 1977, pp. 3-21.

40. Solomon, Daniel, Bezdek, William E., and Rosenberg, Larry, Teaching Styles and Learning, Center for the Study of Liberal Education for Adults, 1963.

41. Tarule, Jill Mattuck, and Weathersby, Rita, "Adult Development and Adult Learning Styles: The Message for Non-Traditional Graduate Programs," Alternative Higher Education: The Journal of Non-Traditional Studies, Vol. 4, No. 4, No. 1, Fall, 1979, pp. 11-23.

42. Taub, Harvey A., and Kline, Gary E., "Modality Effects of Memory in the Aged," Educational Gerontology, Vol. 1, No. 1, 1976, pp. 53-60.

43. Tenore, Elizabeth J., and Dunbar, Shirley E., One Step Beyond: A Systems Approach to Deliverying Individualized Instruction, Berkshire Community Press, Inc., 1979.

44. Terrell, William R., "Anxiety Level Modification by Cognitive Style," Individuality in Learning, Samuel Messick and Associates, Jossey-Bass Publishers, Inc., 1976.

45. Wapner, Seymour, "Process and Context in the Conception of Cognitive Style," Individuality in Learning, Samuel Messick and Associates, Jossey-Bass Publishers, Inc., 1976.

BIBLIOGRAPHY (CONTINUED)

46. Weathersby, Rita, "A Synthesis of Research and Theory on Adult Development: Its Implications for Adult Learning and Postsecondary Education," Special Qualifying Paper for Harvard University Graduate School of Education, March, 1976, 178 p., ED 165 678.

47. Williams, Graham L., "Adults Learning About Adult Learning," Adult Education, London, Vol. 52, No. 6, March, 1980, pp. 386-391.

48. Witkin, Herman A., "The Role of Cognitive Styles in Academic Performance and in Teacher-Student Relations," Princeton, New Jersey, Educational Testing Service, 1973, ED 083 248.

49. Witkin, Herman A., "Cognitive Style in Academic Performance and in Teacher-Student Relations," Individuality in Learning, Samuel Messick and Associates, Jossey-Bass Publishers, Inc., 1976.

50. Witkin, Herman A., Moore, C. A., Goodenough, D. R., and Cox, P. W., "Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications," Review of Education Research, No. 47, January, 1977, pp. 1-64.

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